CLAIM

1. A method to be used with a set of CT helical data corresponding to a thick slice of interest (TSOI), the method for generating a thick slice data weighting function $w(\beta)$ by combining slice specific Z-smoothing scalars zw and helical slice image weight functions hw corresponding to first through N slice images to be combined to generate the thick slice image corresponding to the TSOI, the method comprising the steps of:

(a) for the first slice, mathematically combining the helical weight function hw and an image specific scalar zw(n) to generate a scaled weighting function $w_n(\beta)$ corresponding to the first slice;

(b) storing scaled weighting function $w_n(\beta)$ weights at the beginning of an intermediate weighting array $w_{iti}(\beta)$;

(c) for the next adjacent slice, mathematically combining the helical weighting function hw and an image specific scalar zw(n) to generate a scaled weighting function $w_n(\beta)$;

(d) identifying an overlapping segment of the scaled weighting function $w_n(\beta)$ that overlaps an overlapped segment of the intermediate weighting array $w_{iti}(\beta)$ and adding the overlapping segment weights to the overlapped segment weights;

(e) storing the function $w_n(\beta)$ segment weights that do not overlap the intermediate weighting function array at the end of the intermediate weighting function array;

(f) repeating steps (c) through (e) for each of the slice images to be combined to generate the thick image; and

(g) outputting the intermediate weighting function array as a final weighting array $w_{ti}(\beta)$.

2. The method of claim 1 wherein the steps of mathematically combining include the step of multiplying a scalar by a corresponding function.

3. The method of claim 1 also for use with a system wherein an optimal Z-smoothing factor zsf is provided and also for identifying an optimal number zns of two dimensional images corresponding to data to be combine to generate a thick image, the method further including the step of mathematically manipulating the zsf factor to identify the optimal value zns.

4. The method of claim 3 wherein the step of mathematically manipulating includes the step of solving the following equation:

$$zns = 2fceil(zsf-1)+1$$

where fceil is a ceiling function that rounds decimal values up to the next integer value.

5. The method of claim 1 also for use with a system wherein an optimal Z-smoothing factor zsf is provided and also for identifying an optimal set of data to be used to generate the thick image, the method further comprising the step of solving the following equation to determine the optimal set of data $\beta_z$ as a function of gantry angle by solving the following equation:

$$\beta_z = \beta_n(zsf + 1)$$

where $\beta_n$ is half of the minimum gantry rotation angle spanned by the center CT detector in any detector row required to collect data needed to generate a single slice image while $\beta_z$ is the gantry rotation angle spanned by the center detector of the same row required to collect data needed to generate a thick image according to a Z-smoothing algorithm.

6. The method of claim 5 further including the step of applying the final weighting array $w_{ti}(\beta)$ to the data corresponding to gantry angle $\beta_z$.

7. A method to be used with a set of CT helical data corresponding to a thick slice of interest (TSOI), the method for generating a thick slice data weighting function $w(\beta)$ by combining Z-smoothing functions zw and helical slice image weight functions hw, the thick slice data weighting function useable to generate a thick slice image corresponding to the TSOI, the method comprising the steps of, where a slice image quantity is identified as N:

(a) setting a slice counter n to zero;

(b) mathematically combining hw and zw(n) to generate a scaled weighting function $w_n(\beta)$;

(c) storing function segment $w_n(\beta i, \beta_{full})$ to intermediate function segment $w(\beta i, \beta_{full})$;

(d) incrementing counter n;

(e) if n is equal to N, skipping to step (g), else:

(1) mathematically combining hw and zw(n) to generate scaled weighting function $w_n(\beta)$;

(2) adding $w_n(0,\beta_{lap})$ to $w_{iti}(n(\beta_{full}-\beta_{lap}), n(\beta_{full}-b_{lap})+\beta_{lap}))$;

(3) storing $w_n(\beta_{lap}, \beta_{full})$ to $w_{iti}(n(\beta_{full}-\beta_{lap})+\beta_{lap}, n(\beta_{full}-b_{lap})+\beta_{full}))$;

(f) repeating steps (d) through (e); and

(g) outputting intermediate function $w_{iti}(\beta)$ as a final function $w_{iti}(\beta)$;

where the first and second angles $\beta 1$ and $\beta 2$ in each function segment $w_n(\beta 1, \beta 2)$ and $w(\beta 1, \beta 2)$ correspond to a first gantry angle in the corresponding function segment and the length of the function segment, respectively, $\beta i$ corresponds to the first angle in a function, $\beta_{full}$ corresponds to the total length of a scaled function, and $\beta_{lap}$ corresponds to the segments of adjacent weighting functions that overlap.

8. The method of claim 7 wherein each function zw is a scalar and the steps of mathematically combining include the step of scaling helical weighting function by a corresponding scalar.

9. The method of claim 7 also for use with a system wherein an optimal Z-smoothing factor zsf is provided and also for identifying an optimal number zns of two dimensional images corresponding to data to be combine to generate a thick image, the method further including the step of mathematically manipulating the zsf to identify the optimal value zns.

10. The method of claim 9 wherein the step of mathematically manipulating includes the step of solving the following equation:

$$zns = 2fceil(zsf\text{-}1)+1$$

where fceil is a ceiling function that rounds decimal values up to the next integer value.

11. The method of claim 7 also for use with a system wherein an optimal Z-smoothing factor zsf is provided and also for identifying an optimal set of data to be used to generate the thick image, the method further comprising the step of solving the following equation to determine the optimal set of data $\beta_z$ as a function of gantry angle by solving the following equation:

$$\beta_z = \beta_n(zsf + 1)$$

where $\beta_n$ is half of the minimum gantry rotation angle spanned by the center CT detector in any detector row required to collect data needed to generate a single slice image while $\beta_z$ is the gantry rotation angle spanned by the center detector of the same row required to collect data needed to generate a thick image according to a Z-smoothing algorithm.

12. The method of claim 11 further including the step of applying the final weighting array $w_{ti}(\beta)$ to the data corresponding to gantry angle $\beta_z$.

13. An apparatus to be used with a set of CT helical data corresponding to a thick slice of interest (TSOI), the apparatus for generating a thick slice data weighting function $w(\beta)$ by combining Z-smoothing functions zw and helical slice image weight functions hw, the thick slice data weighting function useable to generate a thick slice image corresponding to the TSOI, the apparatus comprising, where a slice image quantity is identified as N:

a processor running a pulse sequencing program to perform the steps of:

(a) setting a slice counter n to zero;

(b) mathematically combining hw and zw(n) to generate scaled weighting function $w_n(\beta)$;

(c) storing function segment $w_n(\beta i, \beta_{full})$ to intermediate function segment $w_{iti}(\beta i, \beta_{full})$;

(d) incrementing counter n;

(e) if n is equal to N, skipping to step (g), else:

(1) mathematically combining hw and zw(n) to generate scaled weighting function $w_n(\beta)$;

(2) adding $w_n(0,\beta_{lap})$ to $w(n(\beta_{full}-\beta_{lap}), n(\beta_{full}-b_{lap})+\beta_{lap}))$;

(3) storing $w_n(\beta_{lap}, \beta_{full})$ to $w(n(\beta_{full}-\beta_{lap})+\beta_{lap}, n(\beta_{full}-b_{lap})+\beta_{full}))$;

(f) repeating steps (d) through (e); and

(g) outputting intermediate function $w_{iti}(\beta)$ as final function $w_{tt}(\beta)$ ;

where the first and second angles $\beta 1$ and $\beta 2$ in each function segment $w_n(\beta 1, \beta 2)$ and $w(\beta 1, \beta 2)$ correspond to a first gantry angle in the corresponding function segment and the length of the function segment, respectively, $\beta i$ corresponds to the first angle in a function, $\beta_{full}$ corresponds to the total length of a scaled weighting function, and $\beta_{lap}$ corresponds to the segments of adjacent weighting functions that overlap.

14. The apparatus of claim 13 wherein each function zw is a scalar and the program causes the processor to mathematically combine by multiplying a scalar by a corresponding helical weighting function.

15. The apparatus of claim 13 also for use with a system wherein an optimal Z-smoothing factor zsf is provided and also for identifying an optimal number zns of two dimensional images corresponding to data to be combine to generate a thick image, the program further causing the processor to mathematically manipulating the zsf to identify an optimal value zns.

16. The apparatus of claim 15 wherein the program causes the processor to mathematically manipulate by solving the following equation:

$$zns = 2fceil(zsf-1)+1$$

where fceil is a ceiling function that rounds decimal values up to the next integer value.

17. The apparatus of claim 13 also for use with a system wherein an optimal Z-smoothing factor zsf is provided and also for identifying an optimal set of data to be used to generate the thick image, the program further causing the processor to solve the following equation to determine the optimal set of data $\beta_z$ as a function of gantry angle by solving the following equation:

$$\beta_z = \beta_n(zsf + 1)$$

where $\beta_n$ is half of the minimum gantry rotation angle spanned by the center CT detector in any detector row required to collect data needed to generate a single slice image while $\beta_z$ is the gantry rotation angle spanned by the center detector of the same row required to collect data needed to generate a thick image according to a Z-smoothing algorithm.

18. The apparatus of claim 17 wherein the program further causes the processor to apply the final weighting array $w_{ti}(\beta)$ to the data corresponding to gantry angle $\beta_z$.

19. A method to be used with a set of CT helical data corresponding to a thick slice of interest (TSOI) and a CT system that provides an optimal Z-smoothing factor zsf, the method for identifying an optimal number zns of slice images through the TSOI to be combined to generate a thick image corresponding to the TSOI, the method comprising the step of solving the following equation:

$$zns = 2fceil(zsf-1)+1$$

where fceil is a ceiling function that rounds decimal values up to the next integer value.

20. An apparatus to be used with a set of CT helical data corresponding to a thick slice of interest (TSOI), the apparatus for generating a thick slice data weighting function $w(\beta)$ by combining slice specific Z-smoothing scalars zw and helical slice image weight functions hw corresponding to first through N slice images to be combined to generate the thick slice image corresponding to the TSOI, the apparatus comprising:

a processor running a pulse sequencing program to perform the steps of:

(a) for the first slice, mathematically combining the helical weight function hw and an image specific scalar zw(n) to generate a scaled weighting function $w_n(\beta)$ corresponding to the first slice;

(b) storing weighting function $w_n(\beta)$ weights at the beginning of an intermediate weighting array $w_{iti}(\beta)$;

(c) for the next adjacent slice, mathematically combining the helical weighting function hw and a slice specific scalar zw(n) to generate a scaled weighting function $w_n(\beta)$;

(d) identifying an overlapping segment of the scaled weighting function that overlaps an overlapped segment of the intermediate weighting array and adding the overlapping segment weights to the overlapped segment weights;

(e) storing the scaled function $w_n(\beta)$ segment weights that do not overlap the intermediate weighting function array at the end of the intermediate weighting function array;

(f) repeating steps (c) through (e) for each of the slice images to be combined to generate the thick image; and

(g) outputting the intermediate function as a final weighting array $w_{ti}(\beta)$ .